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MACHINERY FOR DUSTING COTTON

1934

DUSTING COTTON PLANTS with finely powdered calcium arsenate has been the most economical and successful means used for the control of the bollweevil for over 15 years. Successful results from dusting, however, depend largely upon the type and efficiency of the dusting machinery selected.

This bulletin is intended to help the grower select the machinery that is best suited to his needs and the conditions existing on his own farm. It supersedes Farmers' Bulletin 1319, Cotton Dusting Machinery.

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MACHINERY FOR DUSTING COTTON

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NEW DEVELOPMENTS IN COTTON-DUSTING MACHINERY

MANY CHANGES and improvements have been made in the designs and construction of dusting machinery since 1923, when the last publication of the Department of Agriculture on this subject was issued. It is the purpose of this bulletin to furnish information that will help the cotton farmer to select the dusting machinery best suited to his individual requirements.

For over 12 years specialists in agricultural engineering and entomologists of the Department have been working in cooperation in the development of new and better types of dusting machinery and have furnished interested manufacturers with detailed descriptions and specifications that have resulted from this work. They have also assisted in testing and improving models submitted by manufacturers. As an outcome of this cooperative work satisfactory machines can now be purchased to meet practically every condition found on either small or large farms and at prices within the means of practically every cotton grower.

SELECTION OF DUSTING MACHINERY

To control the bollweevil it is generally necessary to dust the cotton at intervals of 4 or 5 days until the weevils have been reduced in numbers below the point at which they cause appreciable injury. To accomplish this, a type of machine should be selected with capacity for covering the area to be dusted well within this 4- or 5-day period. As an aid in determining the best type of machine to meet individual needs, the capacities of different types and models discussed later in this bulletin are there indicated. In calculating the machine capacity, allowance must be made for the probability that unfavorable weather or other conditions may interrupt or delay dusting. There-

[1] M. D. Kearney conducted the field and calibration tests with the cotton-dusting machines discussed in this bulletin. G. A. Maloney assisted the writers in the preparation of the bulletin.

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fore the daily and seasonal acreage that each machine can reasonably be expected to dust, as given herein, is about 25 percent less than the area that could be covered if it were possible to use the machine continuously.

On large, open fields, clear of stumps or other obstructions, the larger types of machines will be found most efficient and economical, whereas fields of small size, irregular in shape, or with short rows requiring frequent turns, or containing stumps, will require the small machine of the one-mule type or the saddle gun or hand gun.

The selection of dusting machinery should be influenced to some extent by the character of labor available for its operation. However, little difficulty should be encountered with the improved machinery now on the market, since most of the newer models can be successfully operated by any intelligent farm hand, if he is carefully instructed.

Calcium arsenate in a dry, finely powdered form, such as is recommended by the Bureau of Entomology for control of the bollweevil, requires especially designed machinery. Many models of dusting machines that have been placed on the market are totally unsuited for the proper distribution of calcium arsenate, and much loss to farmers has resulted from their use. The types of dusting machines described herein, all of which can be purchased, have been designed to secure good distribution of the dust.

In selecting a machine the following points should be noted:

(1) The dusting machine should be provided with some device in the hopper that will keep the dust constantly agitated and in a light and fluffy condition, so that it will flow readily and at a uniform rate from the hopper. This is necessary to overcome the pronounced tendency of calcium arsenate to become sticky by absorbing moisture from the air and to pack quickly when subjected to vibration.

(2) The feeding mechanism should be such as will keep an even quantity of dust flowing through the feed opening at any desired poundage per acre.

(3) All parts of the machine, such as the agitator, the feeding mechanism, and the channels through which the air and dust pass, should be of easy access for cleaning, and the discharge tubes should be smooth on the inside and free from square turns, or sharp curves, since at such places the dust may accumulate and retard the flow or even stop it entirely.

(4) The dust-ladened air should have free and unobstructed passage through the machine and discharge tubes at all times.

(5) Dusting machines should be constructed of as light material as possible, to avoid excessive weight, but should be strongly braced to withstand the strain to which they will be subjected in field operations, particularly so as to avoid break-downs which might prevent adequate control of the weevil.

DAY OR NIGHT DUSTING

The discharge of calcium arsenate from the nozzles should be in the form of a light dust cloud or fog. If lumps or small pellets are discharged they represent so much waste, as only the very fine particles will adhere to the plant and be effective in poisoning the weevil. It follows that such dust, prior to settling upon the plants, is easily blown away. For this reason a great deal of the dusting of cotton is done at night in localities where the air is then generally more calm and when the dew present on the plants causes better adherence of the dust. Under these conditions and with a downward discharge, the dust will float among the plants and settle more evenly on all the parts.

With the better machines now available the blowing away of the dust is overcome to some extent by increased fan power and nozzle adjustment to direct the dust with greater force downward among the plants, and with such machines daylight dusting is possible during periods of light air movement.

The most satisfactory results from dusting, however, will be secured during those periods of either day or night when there is little or no air movement, and such periods should be taken advantage of by the farmer.

Dusting at night usually requires artificial lighting. Repairs to the machinery are more difficult then, and it is less easy for the driver to note whether the discharge of the dust is continuous and in a cloud sufficient to cover the plants properly. Furthermore, the presence of heavy dew requires the use of machinery so constructed as to keep the moisture from interfering with important moving parts. The disagreeable features and slight additional cost attending the night dusting are compensated for, however, by the superior results obtained.

TYPES OF DUSTING MACHINES

The many different models of machines offered for sale may be grouped in the following classes, or types, each type having certain well-defined mechanical features and purposes:

(1) The hand guns and saddle guns, the machinery of which is operated by a crank turned by hand.

(2) The traction machine in which the power for operating the dusting mechanism is taken from the traction wheels through chains or gears.

(3) The power duster which is operated by a gasoline engine mounted on the platform and connected with dusting mechanism by a belt or shaft.

(4) The tractor-power duster which is mounted on a platform and bolted and braced to the rear of a tractor, the power for its operation being furnished from the tractor power take-off.

A brief description is given of these various types of machines. Their acreage capacity and their adaptability in meeting different requirements are indicated.

HAND GUN

The hand gun is the smallest type of dusting machine. It is carried by the operator, supported by straps across the shoulders, is cranked by hand, and has a single nozzle for dusting one row of cotton (fig. 1). It is constructed of sheet metal sufficiently strong to withstand the rough handling that a machine of this type usually receives from the average laborer. It weighs about 20 pounds when the hopper is full of dust. In order to prevent strain or fatigue when cranking it is very important that the hand gun be so balanced that the greatest weight will be as close to the body of the operator as possible. The operation of a hand gun is a laborious task at best. This makes it the least satisfactory of the various types of dusting machines.

The chief advantages of hand guns over other and larger types are their lower initial cost and their adaptability for use in places inaccessible to larger machines and for dusting areas too small to justify the purchase of a larger and more expensive machine. As a

general rule one hand gun will take care of the dusting of about 8 acres of cotton.

Hand guns which will last 3 or 4 years, if given reasonable care, can be purchased for not over $18 or $20, but it is poor economy to use hand guns unless no other type of machine is found suitable for the local conditions.

SADDLE GUN

The saddle gun is constructed of lightweight sheet metal and is designed to be attached to the pommel of a saddle. It is operated by the rider by hand-cranking (fig. 2). These machines have two nozzles, one extending down on each side of the animal, and dust two rows at a time. The nozzles of some models can be raised or lowered for the dusting of plants of different heights.

The saddle gun can be used under practically all conditions encountered in cotton dusting and in places where no dusting machine

FIGURE 1.—Dusting cotton with hand guns.

mounted on wheels could be operated successfully. It was not designed to replace the larger types of machines, but rather to supplement them and meet a demand for a machine priced between the hand gun and the larger and more costly models, and to permit the operator to ride and thus avoid contact with the dust cloud and wet cotton during night operation.

Saddle guns now on the market sell for from about $47 to $57, complete with saddle and attachments, and one should dust 15 acres in a day or night and care for the dusting of 40 to 50 acres of cotton in a season.

ONE-MULE MACHINE

The name "one-mule machine" has in the past been used to designate a machine drawn by one animal and having 2 nozzles, which would dust 2 rows of cotton (fig. 3). At present, however, there are available one-mule machines equipped with 4 nozzles,

FIGURE 2.—Saddle gun in operation in a cotton field.

FIGURE 3.—One-mule dusting machine delivering dust.

which will dust 4 rows or more at each trip. Some are narrow models for use between 2 rows of cotton, with the operator walking. Of these, there are one-wheel machines with shafts, others with 1 or 2 wheels and a singletree hitch, and others with 2 wheels and a caster wheel in front by which the machine is guided by the operator. The riding type has 2 wheels and straddles 1 row of cotton.

The most satisfactory one-mule machines are of strong but light construction for ease in handling by the driver, and are equipped with ball bearings on all important moving parts to insure constant and efficient operation with the power provided by the traction wheel. The walking type of the one-mule machine can readily be guided around stumps and turned at ends of rows, can be operated

FIGURE 4.—Dusting cotton with a traction-power cart machine.

in any place in a cotton field where a mule or horse can walk, and is well adapted for use on hillsides and terraced land.

These machines range in price from about $65 for the walking type to $145 for the riding type. The hopper capacity of the various models ranges from 20 to 40 pounds of dust. The 2-nozzle machines will dust from 15 to 20 acres a day and care for the dusting of from 40 to 60 acres of cotton during a season, while the 4-nozzle machines will dust approximately twice as many acres as the 2-nozzle machines.

TRACTION-POWER CART MACHINE

The traction-power cart machine (fig. 4) is mounted on 2 wheels, the power for operating the dusting mechanism being taken from 1 or both wheels. In most models the axle is adjustable from 36 to 54 inches and is arched to a height sufficient to clear the plants in the row being straddled. These machines have from 3 to 5 nozzles, 1 nozzle over the row being straddled and the other nozzles

over the rows on each side of the machine. Machines of this type are best suited for operation on large, open fields, clear of stumps or other obstructions, and the most modern and satisfactory models are fitted with ballbearings on all moving parts to lighten the draft and insure ease of operation. The hopper capacity ranges from about 35 to 75 pounds of dust, and the hopper can easily be refilled by the driver from a barrel of dust, which can be carried on the platform of the machine.

The price range on various models of this type now on the market is approximately from $175 to $300. One of these machines will dust from 35 to 50 acres in 10 hours and should care for the dusting of from 75 to 150 acres during a season.

POWER-OPERATED MACHINES

In 1922 the first model of a two-wheel-cart type of engine-powered cotton duster which could be safely and economically operated in a cotton field was designed by engineers of the Department of Agriculture at Tallulah, La. The aim was to develop a machine that would produce a sufficient velocity of air to break up and separate the dust particles thoroughly, effect a uniform coverage of the cotton plants, and increase the acreage that could be covered in a day or night of operation. Several types of power dusters which meet the various conditions and requirements of cotton growers have been produced and placed on the market during the last 7 or 8 years. The most satisfactory power dusters are those that have the least complicated machinery and a gasoline engine of sufficient power mounted on a platform of a light but sturdily built two-wheel cart.

SINGLE-NOZZLE TYPE

The single-nozzle, power-operated duster (fig. 5), several models of which have been placed on the market during the last 7 years, follows closely the general design of the duster developed by engineers at the Tallulah laboratory. It is provided with a single nozzle at the rear which is moved constantly from right to left and through which dust is discharged down among the cotton plants by a powerful blast of air from the fan, dusting 7 or 8 rows of cotton at each trip across a cotton field.

Machines of this type sell for about $300. They require two mules or horses to draw them and will care for the dusting of from 200 to 300 acres in a season.

MULTIPLE-NOZZLE TYPE

In the class of power-operated dusters are models having 4 or 5 nozzles each, which require only 1 mule or horse to draw them, and will dust 4 or 5 rows of cotton at each trip over a field. Other models of this type, but of heavier construction, requiring 2 mules or horses to draw them (fig. 6), are equipped with additional nozzles and will dust up to 10 rows of cotton at each trip. These larger models carry larger quantities of dust in the hoppers and are intended to meet the needs of the larger cotton growers. Some large power dusters have frames for supporting the dust-discharge tubes that extend beyond

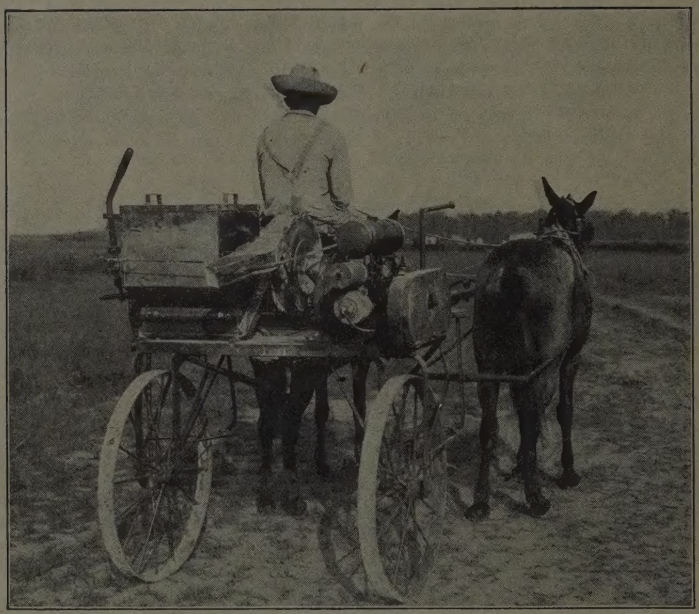

FIGURE 5.—Single-nozzle type of engine-powered cotton duster. In this duster the feed mechanism is operated by a chain and sprocket drive from one of the wheels.

FIGURE 6.—Five-nozzle engine-powered duster in operation.

the sides of the machine. These frames can be raised or folded by the driver from his position on the seat to permit the machine to pass through narrow gates or other openings without damage and to avoid obstructions that may be encountered in turning at ends of rows while dusting or in moving the machine to or from the field.

UNMOUNTED DUSTING UNITS

Power-dusting units mounted upon a wooden base are also on the market at a price considerably lower than that asked for the duster mounted on a cart. These units consist of a complete dusting machine and a gasoline engine, assembled and ready for operation, which can be mounted on any homemade cart or other 2-wheel vehicle that the

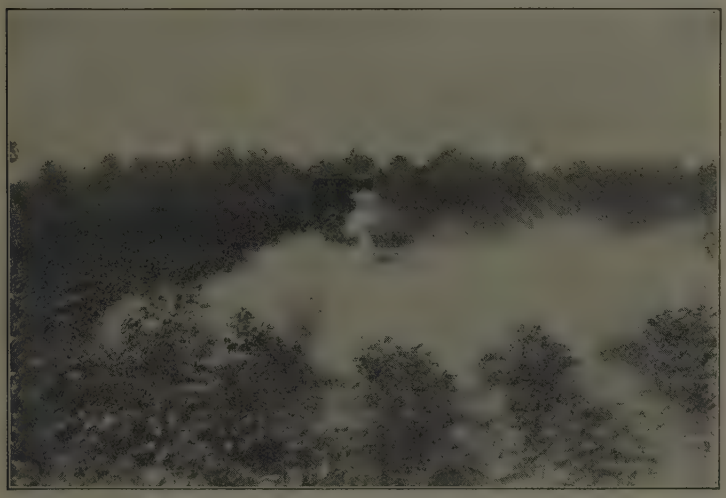

FIGURE 7.—Single-nozzle type of tractor-operated duster.

farmer may have or may be able to construct from parts of other farm machinery not in use.

TRACTOR-OPERATED DUSTERS

Dusting machines mounted on a platform that can be bolted and braced to the rear of a tractor (fig. 7) and operated from the tractor power take-off have been in use for several years on farms where tractors have been employed for cotton cultivation. One type has a single large nozzle that moves back and forth and directs the dust cloud down among the cotton plants. Another type has a single rigid, but adjustable, discharge outlet. From 7 to 8 rows of cotton can be dusted with these machines at each trip across a cotton field. Other types of dusting machines for operation by tractors are equipped with five or more discharge tubes.

The speed at which a tractor can be driven through a cotton field makes it possible to dust a greater acreage than with horse-drawn machinery of equal row capacity.

COMBINATION CULTIVATOR-DUSTERS

In some localities where riding cultivators are used there has developed a demand during the last few years for cotton-dusting equipment that can be attached to horse-drawn cultivators in order that dusting and cultivation may be accomplished at one operation. Some of the light dusting machines, of the hand-gun or saddle-gun type, can be attached to the frame of a cultivator and operated by chain and sprocket from the cultivator wheel. The 1-row cultivator-duster (fig. 8) is provided with 1 nozzle for dusting 1 row of cotton,

FIGURE 8.—Hand gun attached to a one-row cultivator and geared to the wheel.

and the 2-row duster (fig. 9) with 2 nozzles for dusting 2 rows, the dust being discharged behind the driver's seat.

The dusting capacity of the cultivator-dusters is limited to the acreage that they will cover during cultivation, and these machines are not suitable for dusting after cotton is laid by. They may be used in localities where cotton produces a moderate growth of plants and where the air during the day is sufficiently calm to make effective dusting possible. In localities where weevil damage may continue, or occur after cultivation is completed, machines of other types will be required for the necessary dusting.

LIGHTING EQUIPMENT

When operating dusting machinery at night it is necessary that a lighting system be provided that will withstand the jars and vibrations to which it will be subjected by the travel of the machine over a rough cotton field. For use on the larger machines an automobile headlight or spotlight, mounted on a standard for proper focusing, and operated by a storage battery carried on the platform of the cart, is satisfactory and economical. A satisfactory but considerably more expensive carbide light of a special design for dusting machines was developed about 10 years ago and has been furnished by some manufacturers of dusting machines as standard equipment. Lights of this type sell for from $30 to $45.

Such brilliant illumination is not necessary for night operation of the one-mule machine or saddle gun. For the one-mule machine an

FIGURE 9.—Saddle gun attached to and operated by a two-row cultivator.

ordinary oil-burning lantern or a dry-cell electric lamp mounted or hung on the frame will furnish sufficient light to meet ordinary requirements. A satisfactory light for use with the saddle gun is furnished by either a small carbide or dry-cell-electric head lamp fastened to the front of the rider's cap or worn on a band around his head. Such a light can be purchased at most hardware or general-merchandise stores for about $1.50 for the carbide lamp and about $3.50 to $4 for the electric lamp. These small head lamps will also be found satisfactory when dusting on very dark nights with hand guns.

COST OF OPERATION

The cost of dusting depends so much upon the farmer's personal supervision and management of his dusting operations, the interest taken by the labor employed in the operation, and the care given

the dusting machinery (all of which are vital to economic operation) that it is practically impossible to give any figures that could apply in all cases. However, in the operation of the larger types of dusters on many farms, records of which have been carefully kept over a period of years, the cost of a season's operations very closely approximates an average of 75 cents to $1 for each acre application, depending upon the cost of the dust. This figure includes a depreciation charge on machinery, the cost of labor, the cost of dust, and upkeep and repairs on machines.

CARE OF DUSTING MACHINERY

The most efficient and profitable service from any dusting machinery can be secured only through the use of intelligence in its care and operation. Most of the dusting machines now on the market are shipped from the factory assembled and ready for field operation, excepting that the wheels and pole or shafts are usually detached for shipment, to reduce the bulk. All gears and moving parts are usually oiled and greased.

Before the machine is taken to the field, study the instructions for operation furnished by the manufacturer and examine the machine carefully to be sure that every part will work smoothly and without friction. This careful inspection should always be repeated before each day's operations, and oil or grease should be applied as often as may be found necessary. Proper lubrication of all moving parts of a dusting machine is as necessary for efficient operation and long service as for an automobile, a tractor, or any other piece of farm machinery.

Where possible, keep dusting machinery under cover and out of the weather when not in use. At the end of the season clean the machine thoroughly, remove all dust from the hopper, and blow all dust from the channels through which the dust passes, including the rubber or metal hose lines. If the machine has rubber hose see that it is not kinked or sharply bent, as these defects tend to become permanent if permitted to remain for any great length of time.

AIRPLANE DUSTING

The airplane as a cotton-dusting machine cannot be considered in the same class with farmer-owned dusting machinery operated on the ground. However, in many districts of the Cotton Belt during the last 7 years, the airplane (fig. 10) has come to be regarded as a valuable and important machine where the control of the bollweevil and other cotton insects on an extensive scale has been necessary.

The purchase of an airplane equipped for dusting and the employment of an experienced pilot and mechanic for its operation and upkeep would be justifiable from an economic standpoint only for the very largest cotton producers, or corporations engaged in unusually large farming operations.

From 1922 to 1930, engineers of the Department of Agriculture carried on extensive experiments at Tallulah, La., in developing dusting mechanisms that could be installed and used in different makes and models of airplanes for the control of the bollweevil and other insects. These experiments showed airplane dusting to be so success-

ful and aroused such interest among cotton growers and airplane manufacturers that corporations were organized for commercial airplane dusting, and since 1925 this industry has become well established. These organizations operate under contracts made with cotton growers on a basis of a given price per acre to be dusted or at a given price per pound of dust to be applied.

Commercial dusting of cotton with airplanes is done most economically for the farmer on a community or "syndicated-farms" basis. This involves the pooling of cotton acreages by a number of farmers whose farms are reasonably close to one another, under contract with an airplane-dusting company at a price based on the combined cotton acreage of all who sign contracts. Under this plan the cost per acre for each farmer signing the contract depends upon the total acreage of all who are associated with him in the pool, the cost to the farmer having a small acreage being the same per acre as to the one having the largest acreage. The price per acre includes the cost of dust and all other charges, and the dusting is done under the

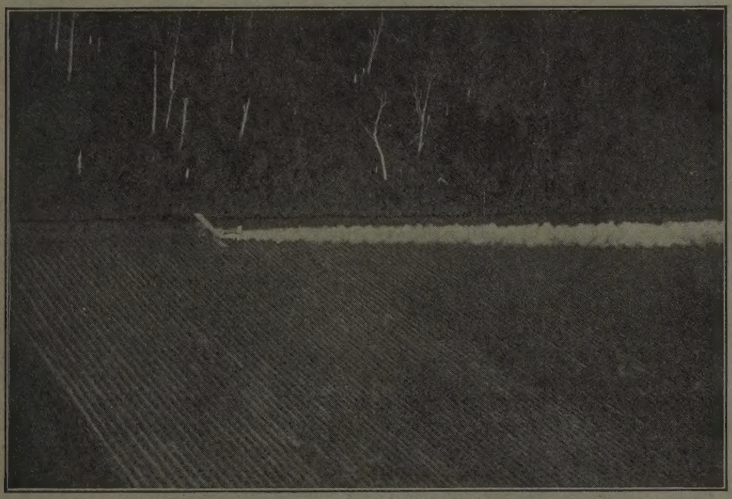

FIGURE 10.—Airplane dusting cotton.

direction and supervision of the farmer himself. In another form of contract the dusting company sells only its service in applying dust at a definite price for each acre application, or at a given price per pound of dust applied, the farmer furnishing or paying for the dust. By this plan the farmers may accomplish a saving if they are able to purchase the dust cooperatively at a lower price than the dusting company can furnish it.

The airplane dusting of cotton presents some outstanding advantages to the farmer over dusting with ground machinery. Of most importance is the fact that it is possible immediately after heavy or protracted rains to fly over muddy or boggy fields where weevils may be doing serious damage and where no other type of duster could be operated, possibly for several days.

The speed at which an airplane is flown and the much greater number of cotton rows it dusts at each flight over a field make possible the dusting of approximately 350 or more acres of cotton per hour, which is many times the acreage that can possibly be dusted with any other type of machine in the same length of time.

Airplane dusting is done entirely during daylight and generally during the early morning and late afternoon, as those periods are usually the safest for flying at the low altitudes necessary to insure the dust being driven down among the cotton plants. The velocity at which the dust is driven from the airplane by the air blast from the propeller is so much greater than that from the fan in the ground machines that moderate ground air currents are overcome, and the dust is permitted to settle and cover the plants. The use of airplanes enables the grower to avoid the disagreeable conditions encountered in night dusting, which is often necessary when most types of ground machines are used.

Where it is possible for the farmer to engage airplane-dusting service he will be saved the necessity for investing in dusting machinery and in animal or other power, and labor for its operation and upkeep. Experience has proved that the cost to the farmer of airplane dusting has been no greater than for dusting with other kinds of machinery.

METHODS TO BE AVOIDED

The following dusting methods have proved to be unsatisfactory:

(1) Broadcasting calcium arsenate dust by the use of a powerful motor-driven fan through a single nozzle with the idea of covering large areas from fixed points on the edge of or in the field. The objection here is the lack of uniformity of coverage.

(2) The old-time bag-and-pole method (used with paris green for the control of the cotton leaf worm) is not suitable for applying calcium arsenate dust to cotton plants. The calcium arsenate used for dusting is very finely divided, and the particles pack and stick together in such a way that the dust cloud necessary to give effective control of the bollweevil cannot be produced by this method.

Farmers' Bulletin 1329, The Boll Weevil Problem, and Leaflet 37, Poisoning the Cotton Boll Weevil, are on sale by the Superintendent of Documents, Government Printing Office, Washington, D.C. For additional information regarding the control of insects in the cotton field write to the State agricultural experiment station, or the Bureau of Entomology, United States Department of Agriculture, Washington, D.C.

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